NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION

CARS HANDHELD
POST PROJECT REVIEW REPORT

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PROJECT OVERVIEW

The purpose of this project is the development of an in-house handheld solution for the Construction Automated Records System (CARS) for the North Dakota *Department of Transportation's* (DOT) Construction Services Division. This phase of CARS will entail the creation of a solution for providing Department of Transportation Construction users with handheld technology for the maintenance of Construction data. Department of Transportation Construction users will be able to reference and maintain information while at the project site. This project will begin April 1st, 2004, with a completion\production date of April 1st, 2005.

The North Dakota DOT's, Construction Services Division, has determined that incorporating a handheld technology into the CARS system for the Contractors use will have many benefits. It will provide Construction staff with the ability to enter necessary information directly into an electronic format. This reduces duplication of effort which results from writing the information on paper and having to key that information into a computer later. It will also provide the user with a quick means of searching for project information, which will save time by not making it necessary for the staff to search through paper information. Handheld technology will provide the Construction staff with additional information that will make it faster and more efficient for them to do their job. This in turn will help to keep the project moving by not having to delay decisions until the necessary information to make a decision is available. This will make things easier for Construction staff as well as keep the project moving along on or ahead of schedule, thus providing for the ability to complete projects faster and move needed Construction staff to other projects.

Other benefits of implementing handhelds include:

- Eliminates need to discern notes taken by another individual.
- Reduces delays in decision-making as a result of lack of information.
- Eliminates duplication of effort as a result of writing information down on paper and having to re-enter the information into a computer later.
- Provides for an automated way of transferring data into CARS.
- Ability to quickly approve changes as a result of having more data relating to the project.
- Reduces the amount of time spent entering information into the computer at work which takes away from the amount of time spent at the project site.
- The system would be user-friendly.

The applications will be written conforming to office standards, to a client server, GUI platform, running on a network. The applications will be developed with Visual Basic .Net on a Windows CE platform. The applications will be designed and developed to fully utilize relational database technology and modular user interfaces. The application will be written specifically for Department of Transportation staff at this time. To extend the scope outside of Department of Transportation staff will require a need to increase FTE support time beyond the resources available by the current Department of Transportation staff.

PROJECT OBJECTIVES

The following objectives have been defined for the handheld development project:

- **System must be in place by April 1st, 2005** – The system must be complete, fully operational, meeting all requirements, and in production by the project deadline of April 1st, 2005.
- **System will be accessible to Department of Transportation staff and personnel**.
- **Inspector should be able to Enter Project Diary onsite –** Inspector must be able to enter information, such as notes and drawings, about the project that would be directly uploadable into the CARS system.
- **Inspector should be able to enter Inspector's Reports** – Inspector should be able to enter information into the Inspector's Report. CARS will also have the Inspector's Diaries added to the system.
- **Inspector should be able to view the following Proposal Data (Supplemental Specs and Special Provisions).**
- **Provide a user-friendly interface** – The system must be user friendly, providing extensive on-line help, an easy to understand interface, and be in a GUI format.
- **Provide data validation** – Initial validation as the user key's the information and exits each field. The system will verify the accuracy of item extensions and totals. It will also verify that forms are complete.

Objectives Reviewed

The CARS Handheld Inspection Diary and Project Diary applications were made available to the five pilot districts (Devils Lake, Williston, Grand Forks, Fargo and Bismarck) by the scheduled implementation date of April 1, 2005. Bismarck District later returned their handhelds due to being shorthanded and not having available staff to dedicate to the pilot project. The handheld applications interfaced with the CARS web application for the sharing of Project Diary and Inspection Diary data. Handheld data was validated according to business rules set in place for the CARS web application.

Inspection Diary and Project Diary data was made available on the handhelds through a download process that pulled all active and available information relating to the User. Users had the ability to upload new data back into CARS. Users are required to have a valid CARS User ID to use the handheld applications. The User ID and password are used to manage information that is shared between the handheld applications and the CARS web application. The Information Technology Department created two web services to manage the uploading and downloading data to and from the handhelds.

The Information Technology Department also created an additional module on the existing CARS web application. The Inspection Diary module was set up to function similarly to the existing Project Diary module. It used similar business rules as were set up for the Project Diary and it's look and feel matched that of the Project Diary as well.

Adobe Reader was installed on the handhelds to allow users the ability to download Standard Specification Manuals, Supplemental Specifications and Project related information in PDF format for viewing while at the project site.

Training was held for the members of the pilot districts on Thursday March 17, 2005.

Expanded System Capabilities and Availability of Service:

Noted Service\Savings\Value added for the DOT:

- Eliminates need to discern notes taken by another individual.
- Users were able to add new data and inquire on existing project data, even when not connected to the network.
- Eliminates duplication of effort as a result of writing information down on paper and having to re-enter the information into a computer later.
- Provides for an automated way of transferring data into CARS.
- Reduces the amount of time project managers spent entering information into the computer at work which takes away from the amount of time spent at the project site.
- The applications are user-friendly.

USER RESPONSE

Overall, response from the pilot districts on the project was positive. Adding Inspection Diary data into CARS was very beneficial. More individuals had the ability to access the data and the project engineer was able to reduce the amount of time spent entering Project Diary data by copying information from the Inspection Diary data. The need to discern notes written by Inspectors was greatly reduced, if not eliminated, in most cases. It appears that most of the districts still maintained a paper copy in one aspect or another. A couple of the districts would enter notes on paper and enter them into the handheld later. Some of this was attributed to not having an established comfort level with the device. Fargo District also expanded the use of the handheld into the lab where it was used for storing testing data.

Some of the users felt that the small screen size and short battery life were issues with the handheld devices. The issue with batteries could be resolved by purchasing batteries with a longer life. There were also some suggested enhancements to the applications themselves that would simplify the use of the applications and make them easier to use. The districts tried the keyboards, but found it easier to use the stylus and other features available on the handhelds themselves. Some of the project engineers found that the need didn't exist to use the handhelds. Due to the close proximity of the field office to the project site they were able to make use of their laptops and thus eliminated the need for the handheld. Several users commented that they would like to have a more simplified way of looking at previous days' data. There were also some suggestions of increased field sizes and spell checking capabilities.

The majority of the individuals involved in the pilot project would like to continue using the handhelds. Grand Forks District would like to expand this to everyone in the District. Fargo District would like to continue using the handhelds as well as expanding into more areas with the handhelds. Several individuals in the Williston District would like to use them next year. Some of the individuals didn't see a need for the handhelds as a result of being able to use their laptops in the field office. Devils Lake District was evenly split on those who would like to use them and those who didn't want to use them next year. Several individuals suggested expanding the current applications to laptops and/or tablets. The ability to view and maintain data while not connected to the network was very popular.

LESSONS LEARNED

There was some scrambling done at the end of the project to resolve connection issues. Some of the individuals involved in the pilot project didn't have network access and this resulted in some issues. To resolve this issue, wireless connections were setup in the districts or at field offices. Also, the keyboards provided for the project were not of much use to the individuals while out on the project site and any future plans for handhelds will not include them.

PROJECT SYNOPSIS

The product, or result, of this project is two fully functional handheld applications (Inspection Diary and Project Diary) and a new module for the CARS Web application which conforms to office standards. Two web services were also created to manage the downloading and uploading of CARS data. The handheld applications were developed by Carey Schreiner, DOT – IT. The new module for the CARS web application and two new Web Services were developed by the Information Technology Department.

In summary, the handheld applications and new Inspection Diary module have provided many benefits and are planned to be used and expanded in the coming years. The largest benefit is being able to maintain and view CARS data while not being connected to a network. Project engineers noticed the largest amount of time savings benefits with Inspection Diary data entry into CARS shifting to the Inspectors.

Problem Log Statistics

There were a total of 28 Heat calls directly relating to the CARS Handheld pilot project.

19 of the calls were a result of using handhelds for the first time and a lack of familiarity with the devices.

23 of the calls were resolved within a day.

8 calls were related directly to the applications or files associated with the applications.

9 calls were related to connectivity issues.

3 calls were due to individuals not being set up in the correct Security groups.

Project Time Lines:

The project had a planned start date of April 1, 2004 and a completion date of April 1, 2005. Due to a shift in priorities of projects, the project did not start until September 1, 2004. Work beyond normal business hours was spent by Carey Schreiner to ensure that the project was completed on time.

Training was scheduled for March 17, 2005 so all of the development and testing had to be completed before that date. With the aid of Lance Bargmann (DOT-Construction) and Nancy Horner (DOT-Construction) both handheld applications and the new Inspection Diary module added to the CARS web application were thoroughly tested. The handheld devices were initially set up by Carey Schreiner. All handheld devices and related equipment (storage cards, keyboards, protective cases and auto adapter kits) were distributed to the users the day of training. With help from Lance Bargmann the training class went very smoothly.

Application User Guides, Installation Guides and Quick Tips documents were created by Carey Schreiner (DOT – IT) to serve as reference guides for the pilot districts.

Total Project Costs:

The CARS Handheld Project final costs were $5,568.68 under budget.

DOT's estimated project cost (Budgeted Amount)	$72,000.00
DOT Staff Costs	$19,755.00
DOT Hardware Costs	$14,262.00
Application modifications – ITD (Actual Cost)	$32,414.32
Final Budget Analyses	$5,568.68

Future Considerations:

Items\Concepts that were discussed during this project, but were not within the scope of this project were:

- **Inspector should be able to view Detailed Estimates for Proposals.**
- **Inspector should be able to view Wage Rates for Proposals.**
- **Provides electronic signature capabilities** – ability to capture signatures from contractors.
- **Procedures Manual must be downloadable -** provides the Inspector with additional information that will be helpful in the decision-making process while at the project site.
- **Provide for the entry of Haul Tickets while onsite –** Inspector should be able to enter Haul Ticket information for tracking materials.
- **Pay Items by Section.**
- **Enhancements to be made to CARS to incorporate Materials data entry into the system.**
- **Useful to be able to reference the bidder's proposal or parts of the proposal that weren't identified above, i.e.; green sheets (specs, codes and prices), PS-1 schedules, DBE requirements -** limited proposals are currently made available so that there are not enough for all inspectors.
- **System must provide the ability to check out portions of the Project so that information will not be updateable when checked out by someone else -** safeguards must be in place that will not allow for data to be updated while someone else has downloaded the data. Checks must be in place that will lock this information on the system once it has been checked out and will not allow the information to be updateable until it has been checked in.
- **Inspectors must be able to download Specs and Codes for a Project by Subproject or Group –** must be able to download and check out information so as to not allow another individual the opportunity to update the information that is being used by the Inspector.
- **Provides DBE (Disadvantage Business Enterprise) requirements\goals per contract** – Provide the ability of downloading DBE requirements.
- **Inquiry capabilities on the Last #2 sheet from the last approved estimate -** reference material.
- **A link to the forms (data entry SFN Forms). –** provide the ability to download forms.
- **Ability to preload repetitious fields on pay reports, inspector reports, etc. –** saves time by not having to re-enter repetitious information.
- **Several considerations from the Objectives above will be moved down here once a priority list is set and once the items are identified that will be done.**
- **Add scanning capabilities for Haul Tickets barcodes.**

These items\concepts could possibly be part of future enhancement projects or maybe standalone project that relate to the CARS application.

The new Inspection Diary module for CARS will be made available to all districts for the next Construction season. Review will also be done as to the costs of expanding the handheld applications to laptops/tablet pc's (providing ability to maintain and view CARS data while not connected to a network). Districts with handhelds will be allowed to continue using their handhelds in the upcoming Construction season. There are currently no additional funds available to expand the handhelds to the rest of the districts and others in the pilot districts who did not receive one of the initial handhelds. Additional review and analysis will be done to identify the best devices for individuals and the relevance of purchasing additional handhelds in the future or expanding the project and using laptops/tablets.

PROJECT SIGN-OFF

The CARS Handheld pilot project to evaluate the Inspection Diary and Project Diary handheld applications as well as the Inspection Diary module for the CARS web application is now complete. The DOT Information Technology Division and the Information Technology Department have completed all requests and assignments.

I have reviewed the CARS Handheld Project for the North Dakota Department of Transportation, and agree with the fulfillment of the project as stated in the scope and deliverables of the project.

I endorse and authorize the completion of the project:

Signature	Date
Cal Gendreau, P.E. Construction Engineer	
Doug Faiman IT Director	

Comments: